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**COST OF
WHEY-SOY-DRINK MIX
FOR HUMAN CONSUMPTION**

U.S. DEPARTMENT OF AGRICULTURE ECONOMIC RESEARCH SERVICE

ABSTRACT

Cost estimates for a whey-soy-drink mix being tested for use as a supplementary food in beverage form for overseas preschool feeding programs are compared with prices of an instant corn-soya-milk mix for selected periods. The estimated cost of the whey-soy-drink mix was 20.30 cents per pound in August 1973 and 19.44 cents in January 1974, compared with prices of 15.05 cents and 14.80 cents for the instant corn-soya-milk mix in June 1973 and January 1974, respectively. The higher cost of the whey-soy-drink mix is due to the higher cost of raw materials and processing. Both products are less expensive than nonfat dry milk.

For the whey-soy-drink mix, raw materials represented the greatest proportion of the total cost (79.6 percent in August 1973). Processing and packaging costs accounted for the balance (20.4 percent).

Keywords: Whey products, costs, processing, packaging, soy blend products.

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CONTENTS

	<u>Page</u>
Summary.....	iv
Introduction.....	1
Ingredient Costs.....	1
Processing Costs.....	4
Packaging Costs.....	4
Total Cost of Whey-Soy-Drink Mix.....	5
Impact of Whey-Soy-Drink Mix on Whey Utilization.....	6

SUMMARY

The estimated cost for a whey-soy-drink mix being tested for use as a supplementary food in beverage form for use in overseas preschool feeding programs was 20.30 cents per pound in August 1973 and 19.44 cents in January 1974. These figures are based on packaging in 50-pound export-type bags and do not include any allowance for return on investment or Federal, State, or local income taxes. Purchase price per pound of instant corn-soya-milk mix in June 1973 and January 1974 was 15.05 cents and 14.80 cents, respectively. In June 1973, the wholesale price of nonfat dry milk was 48.40 cents per pound and in January 1974 it was 54.04 cents per pound. The new whey product and instant corn-soya-milk mix are considered complementary rather than competitive products because the whey product is intended for use as a beverage item while the instant corn-soya-milk mix is intended to be used primarily in gruel and other nonbeverage items. Costs are higher for whey-soy-drink mix than for instant corn-soya-milk mix because of a higher total raw material cost and significantly greater processing expenses due to a more complex processing procedure for the whey-soy-drink mix.

Raw materials represent most of the total cost of the whey-soy-drink mix. Including an allowance for plant processing losses of 1.5 percent, raw materials accounted for 79.6 percent of the total cost in August 1973. Evaporating, drying, and blending costs accounted for 16.2 percent. The remaining 4.2 percent went for packaging.

It appears, because of the current pricing structure, that any increased demand for dried whey resulting from the adoption of the whey-soy-drink product in the overseas feeding programs would be supplied by upgrading for human food use some of the spray-dried whey presently going into animal feed.

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INTRODUCTION

In an effort to maintain, and eventually increase, the quantity of food available for foreign distribution at the least cost to the Government, new types of food products are being developed. One of these products is a whey-soy-drink mix. Its intended use is to replace nonfat dry milk in beverage applications in AID overseas preschool feeding programs at a substantially reduced cost. The new whey product and instant corn-soya-milk mix are considered complementary rather than competitive products because the whey product is intended for use as a beverage while the instant corn-soya-milk mix is intended primarily for use as a gruel and in other nonbeverage applications.

This report deals with the estimated cost of a whey-soy-drink mix. Costs of the whey product and instant corn-soya-milk mix are presented to provide Government agencies involved in developing and procuring products a perspective as to a possible price for the new product. Although the two products have different intended uses, instant corn-soya-milk mix provides a useful benchmark for general comparisons since it is a well established blended food product whose cost structure has been extensively studied by the processing industry. Information and data were obtained through discussions with ingredient manufacturers and mix processors and from Government personnel and files. Cost estimates are based on information considered representative for the types of operations required for processing the whey-soy-drink mix. They do not reflect actual costs for a specific company or plant operation.

INGREDIENT COSTS

Tables 1 through 4 show the estimated cost of ingredients used in a whey-soy-drink mix and in an instant corn-soya-milk mix for January 1974, August 1973, January 1973, and January 1972. Price quotations for all ingredients shown in these tables are based on a truckload quantity lot and priced f.o.b. manufacturer's plant or warehouse. Ingredient cost relationships between the two products could differ significantly in the future from those shown here. Which product is in a more favorable (lower cost) position will depend on the price movements of the individual ingredients used in the products.

Table 1--Estimated ingredient costs, January 1974

Ingredient	Whey-sov-drink mix			Ingredient	Instant corn-soya-milk mix		
	Cents/lb.	Quantity	Total		Cents/lb.	Quantity	Total
		required				required	
		for 1 lb.				for 1 lb.	
		mix	cost/lb.			mix	cost/lb.
	Cents	Pounds	Cents		Cents	Pounds	Cents
Whey solids.....	7.50	0.41380	3.1035	Corn meal			
Full fat soy flour.....	15.60	.36490	5.6924	(processed gelatinized).....	7.38	0.6380	4.7084
Soybean oil.....	39.50	.12130	4.7914	Full fat soy flour in lieu			
Corn sugar.....	10.95	.09125	.9992	of defatted flour and oil.....	15.60	.2920	4.5552
Vitamin mix.....	295.00	.00117	.3452	Calcium phosphate.....	11.80	.0060	.0708
Mineral mix.....	19.00	.00758	.1440	Vitamin mix.....	321.00	.0010	.3210
				Mineral mix.....	19.00	.0130	.2470
				Nonfat dry milk....	54.04	.0500	2.7020
Total.....			15.0757	Total.....			12.6044

Table 2--Estimated ingredient costs, August 1973

Whey-soy-drink mix				Instant corn-soya-milk mix				
Ingredient	Cost/lb.	Quantity required for 1 lb. mix	Total cost/lb.	Ingredient	Cost/lb.	Quantity required for 1 lb. mix	Total cost/lb.	
	Cents	Pounds	Cents		Cents	Pounds	Cents	
Whey solids.....	4.75	0.41380	1.9656	Corn meal				
Full fat soy flour.....	23.00	.36490	8.3927	(processed gelatinized).....	8.24	0.6380	5.2571	
Soybean oil.....	34.00	.12130	4.1242	Full fat soy flour in lieu				
Corn sugar.....	10.45	.09125	.9536	of defatted flour and oil.....	23.00	.2920	6.7160	
Vitamin mix.....	295.00	.00117	.3452	Calcium phosphate.....	11.80	.0060	.0708	
Mineral mix.....	19.00	.00758	.1440	Vitamin mix.....	305.00	.0010	.3050	
				Mineral mix.....	13.20	.0130	.1716	
				Nonfat dry milk	48.40	.0500	2.4200	
Total.....			15.9253	Total.....			14.9405	

Table 3--Estimated ingredient costs, January 1973

Ingredient	Whey-soy-drink mix			Ingredient	Instant corn-soya-milk mix		
	Cost/lb.	Quantity	Total		Cost/lb.	Quantity	Total
		required				required	
		for 1 lb.	cost/lb.			for 1 lb.	cost/lb.
	mix			mix			
	Cents	Pounds	Cents		Cents	Pounds	Cents
Whey solids.....	4.25	0.41380	1.7587	Corn meal			
Full fat soy				(processed			
flour.....	12.38	.36490	4.5175	gelatinized)...	4.57	0.6380	2.9157
Soybean oil.....	25.50	.12130	3.0932	Full fat soy			
Corn sugar.....	8.75	.09125	.7984	flour in lieu			
Vitamin mix.....	295.00	.00117	.3452	of defatted			
Mineral mix.....	19.00	.00758	.1440	flour and oil.	12.38	.2920	3.6150
				Calcium			
				phosphate.....	11.80	.0060	.0708
				Vitamin mix.....	305.00	.0010	.3050
				Mineral mix.....	13.20	.0130	.1716
				Nonfat dry milk	39.41	.0500	1.9705
Total.....			10.6570	Total.....			9.0486

Table 4--Estimated ingredient costs, January 1972

Ingredient	Whey-soy-drink mix			Ingredient	Instant corn-soya-milk mix		
	Cost/lb.	Quantity	Total		Cost/lb.	Quantity	Total
		required				required	
		for 1 lb.	cost/lb.			for 1 lb.	cost/lb.
	mix			mix			
	Cents	Pounds	Cents		Cents	Pounds	Cents
Whey solids.....	4.25	0.41380	1.7587	Corn meal			
Full fat soy				(processed			
flour.....	9.35	.36490	3.4118	gelatinized)...	3.95	0.6380	2.5201
Soybean oil.....	27.00	.12130	3.2751	Full fat soy			
Corn sugar.....	8.75	.09125	.7984	flour in lieu			
Vitamin mix.....	310.00	.00117	.3627	of defatted			
Mineral mix.....	19.00	.00758	.1440	flour and oil.	9.35	.2920	2.7302
				Calcium			
				phosphate.....	11.80	.0060	.0708
				Vitamin mix.....	321.00	.0010	.3210
				Mineral mix.....	13.20	.0130	.1716
				Nonfat dry milk	31.85	.0500	1.5925
Total.....			9.7507	Total.....			7.4062

Total ingredient costs for whey-soy-drink mix ranged between 1.0 and 2.5 cents per pound above those for the instant corn-soya-milk mix. It can be inferred from this that instant corn-soya-milk mix would probably be priced lower than whey-soy-drink mix. The difference in total ingredient costs appears to be due primarily to the difference in the volume and price of soybean products used in the whey-soy-drink blend compared with the volume and price of corn meal and soy products in the instant corn-soya-milk product.

PROCESSING COSTS

Instant corn-soya-milk is made by dry blending all of the required ingredients together. It is then packaged in 50-pound export-type bags. Whey-soy-drink mix processing requires (1) a wet-blending stage; (2) an evaporation stage combined with a homogenizing and pasteurizing operation; (3) a drying stage; (4) a dry-blending stage, and (5) packaging in 50-pound export-type bags.

Representative costs per pound of dried mix for the evaporating and drying stages for the whey-soy-drink mix processing procedure are estimated at 1.089 and 1.859 cents, respectively. The estimated combined cost for the required wet and dry blending operations is 0.333 cent per pound of dried whey-soy-drink mix.

The whey-soy-drink mix procedure requires the use of a 16-percent whey concentrate at the beginning stage of the process. If a 26-percent concentrate is delivered to the processing plant, additional water is required to dilute the solids content of the concentrated whey to a 16-percent level. This would require the addition of 1.344 pounds of water for each pound of whey solids in the 26-percent whey concentrate. The cost of removing the water used to dilute the 26-percent whey concentrate to 16 percent would add an estimated 0.580 cent to each pound of final whey-soy-drink mix.

PACKAGING COSTS

Both products are packaged in 50-pound export-type bags and it is assumed no significant differences in packaging costs or equipment would exist between whey-soy-drink mix and instant corn-soya-milk. Since orders placed with a shipping bag manufacturer are produced on a job-lot or custom order basis, back-price information was not available. Therefore, August 1973 costs were used for all cost comparison periods.

At August 1973 prices, 50-pound, 5-ply kraft paper bags with a 3-mil polyethylene liner in 80,000-bag lots would cost \$309.35 per 1,000 bags. Additional costs for printing on two sides plus the gusset amounted to \$8 per 1,000 bags. These prices were quoted for a 16" x 4" x 33" shipping bag.

Packaging costs (excluding materials) were based on earlier published data for the dry milk industry for 1965, ^{1/} updated to a 1972 estimated cost. The packaging cost per 1,000 pounds of milk processed, excluding the cost of packaging materials, was 26.83 cents. Based on 1,000 pounds of milk yielding 121.4 pounds of dried whole milk powder, this cost amounted to 0.221 cent per pound of powder.

Total packaging costs for the whey-soy-drink product are estimated as follows:

<u>Item</u>	<u>Cost per 1,000 bags</u>
Bags (50-lb. export)	\$309.35
Printing (two sides and gusset--one color)	<u>8.00</u>
Material cost	$\$317.35 \div 50,000 = 0.635 \text{ cents/lb.}$
Packaging (labor, overhead, and misc.)	<u>.221 cents/lb.</u>
Total packaging cost	<u>.856 cents/lb.</u>

TOTAL COST OF WHEY-SOY-DRINK MIX

Following are the estimated August 1973 and January 1974 total costs for producing a whey-soy-drink mix. These figures do not include an allowance for return on investment, or Federal, State, or local income taxes.

<u>Item</u>	<u>Cost of mix, cents/lb.</u>	
	<u>August 1973</u>	<u>January 1974</u>
Ingredient cost	15.925	15.076
Allowance for plant loss (1.5 percent)	.239	.226
Evaporating	1.089	1.089
Drying	1.859	1.859
Blending (wet and dry)	.333	.333
Packaging	<u>.856</u>	<u>.856</u>
Total	20.301	19.439

A plant production loss in materials during processing was estimated at 1.5 percent. In a specific operation, the figure might be significantly lower or higher depending on the plant's normal processing efficiency ratio.

Following is a comparison of the estimated cost of whey-soy-drink mix, buying price of instant corn-soya-milk mix, and wholesale price of nonfat dry milk for selected months.

^{1/} Orval G. Kerchner, Economic Aspects of Flexible Dairy Manufacturing Plants. Univ. Minn. Agr. Expt. Sta., Sta. Bul. 487, 1968, pp. 22-23.

1/ Estimated. Does not include allowances for return on investment and taxes or profit. 2/ Estimated average price f.o.b. mill based on average buying price per cwt. delivered to port less 75¢/cwt. for freight charges. 3/ Wholesale market price.

The preceding comparisons indicate that both the whey-soy-drink mix and the instant corn-soya-milk mix are less expensive than nonfat dry milk. Whey-soy-drink mix prices would tend to be above those for instant corn-soya-milk mix because of a higher total ingredient cost and significantly greater processing expenses due to a more complex processing procedure.

Table 5 shows the estimated 1972 whey solids utilization, including both sweet and acid type wheys.

Currently, about 42 percent of all whey solids (sweet and acid) are dried for use in human or animal feed or used in the manufacture of milk sugar and lactose.

An estimated 1,105.4 million pounds of whey solids are not dried or processed for further use. This represents a considerable potential source of protein. However, about 40 percent of this unused whey is estimated to be an acid whey type.

Assuming the Government purchased 120 million pounds of whey-soy-drink mix annually, total demand for whey solids would increase by approximately 49.7 million pounds. It is highly likely that such an increase in demand would divert some of the whey currently being spray dried for animal feed to use in the higher priced human food. Table 6 shows the percentage of total whey production dried for human and animal food by selected States. It appears that any significant increase in the demand for dried whey for human food use would probably have to be supplied by drying plants in Wisconsin and Minnesota.

Although whey is a substitute for nonfat dry milk in many applications, the high prices for nonfat dry milk were not reflected in a significantly greater demand for or in higher prices for the dried whey prior to August 1973. Between August 1973 and January 1974, both the demand and prices for whey moved upward.

Whether a possible increase in demand for dried whey of 49.7 million pounds would result in the drying of greater quantities of whey is not known. This would be contingent upon the availability of drying capacity in the industry and the alternative profit opportunities for drying plants in terms of other dried products.

Table 5--Estimated U.S. whey solids utilization, 1972

Item	: Quantity : produced <u>1/</u>	: Liquid whey : equivalent	: Whey solids : equivalent <u>2/</u>
		<u>Million pounds</u>	
Total cheese production excluding cottage cheese (supplies sweet whey)	: <u>3/2,603.9</u>	22,653.9	1,472.5
Total cottage cheese curd production (yields acid whey)	: <u>3/784.2</u>	6,822.5	<u>443.5</u>
Estimated total whey solids available	:		1,916.0
Dried whey product production	:		
Whey--human food use.....	: <u>4/376.6</u>	5,084.1	330.5
Whey--animal feed use.....	: <u>4/385.4</u>	5,202.9	338.2
Milk sugar and lactose.....	: <u>5/87.3</u>	2,182.5	<u>141.9</u>
Estimated total whey solids used.....	:		810.6
Total whey solids unaccounted for.....	:		1,105.4
If only sweet whey solids used for dried product then sweet whey total unaccounted for.....	: : :		661.9

1/ Cheese and whey production figures are from Production of Manufactured Dairy Products--1972, U.S. Dept. Agr., Statis. Rptg. Serv., Crop Rptg. Board, Da 2-1 (73), June 20, 1973.

2/ Based on liquid whey composition of 93.5% water and 6.5% whey solids.

3/ Converted to liquid whey equivalent on basis of 8.7 pounds liquid whey per pound of cheese.

4/ Converted to liquid whey equivalent on basis of 13.5 pounds of liquid whey per pound of dried whey.

5/ Converted to liquid whey equivalent on basis of 25 pounds of liquid whey per pound of dry lactose.